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The Increasing Mortality After Age Forty- Five—Some Causes and Explanations

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THE INCREASING MORTALITY AFTER AGE FORTY-FIVE—SOME CAUSES AND EXPLANATIONS.*

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It is important that I state the problem of this paper clearly at the very outset. American statisticians have been concerned for some years with the fact that the death rates after age 45 are higher than they were, say, 10 or 15 years ago. Further back than 1900 it is impossible to go because of the lack of accurate data. The figures for the registration states in 1900 compared with those for the same states in 1914† show substantial decreases for every age period and for both sexes up to age 45. After age 45 there is a slight increase in the death rate for males. It is less than 4 per cent. in the age period 45–54; about 10 per cent. in the age period 55–64, and about 4 per cent. in the period 65–74. The age period 75 and over, shows little of importance. For females, the increase does not begin to appear until the age period 65–74. It is then about 1 per cent. higher in 1914 than in 1900. The reader will note that these increases are not very marked. They would call for very little attention were it not for the fact that this 15 year period has been one of extensive development in our public health service and of increasing prosperity in our country. It is perhaps disconcerting that there should have been an increase at all since the mortality rates of the more important European countries have shown no such increases at the corresponding ages.

The problem becomes much more interesting and acute as we leave the total mortality and concern ourselves with that from some of the causes of death which play an important part after age 45. This is, indeed, the phase of the subject that has received the greatest publicity and attention. We find, for example, in the registration area, in the registration states

* Read before the Annual Meeting of the American Statistical Association, Columbus, Ohio, December 28, 1916.

† The death rates for 1914 (registration states as constituted in 1900) were computed on the basis of the estimated population for 1914 distributed by age and sex in accordance with the 1910 census.

and in selected states having the longest period of good registration, that such causes of death as cancer, diabetes, cerebral hemorrhage and apoplexy, organic diseases of the heart, diseases of the arteries, cirrhosis of the liver, and Bright's disease, all show higher death rates in 1914 than in 1900. These causes of death are characteristic of the older age periods of life and in 1914 together accounted for 58.7 per cent. of the total mortality after 45 in the registration states as constituted in 1900. Cirrhosis of the liver shows the least increase in the total death rate, about 10 per cent. in these 15 years. Diseases of the arteries show the highest increase, nearly 454 per cent. Diabetes shows an increase of nearly 76 per cent. and organic diseases of the heart close to 45 per cent. in the same period. This then is our problem: to attempt to identify the factors involved in these higher death rates and to offer an explanation.

Some interesting explanations of the increasing mortality at the higher age groups have already appeared. The increasing industrialism of the country is supposed to subject the individual workman to greater wear and tear, which shows itself in higher death rates after age 45. The influence of the growth of our cities at the expense of the rural districts and the increasing number of persons engaged under the factory system—all of these points have been emphasized. Changing personal habits of life have also been charged with an important part in the phenomenon. It has been suggested that the supposed harder pace of business and social life today, the possibly diminished opportunities to get out in the open, to exercise, and to live moderately, have had an unfavorable effect upon those over 45. This has been the explanation offered by those identified with the Life Extension movement and by the advocates of periodic physical examinations generally. They have found in this thesis a powerful motive for their very useful propaganda. Their statements have in common the basic assumption that there has been a real and significant deterioration in our national vitality at the ages under consideration.

It is my purpose today to urge great caution in our acceptance of this conclusion. As statisticians we should first be sure that the simpler logical requirements of the problem have

been met before we attempt explanations at all; for with the field cleared up there may be no real phenomenon to explain. This is in effect what I propose to show.

In making comparisons we must make certain of the comparability of our data. In terms of the immediate problem, this means that we must be certain that the mortality rates of the earlier period, say 1900, are for a group of persons similar in essential respects to those of the later period. As a general thing, figures for the European countries meet this requirement. If the reports of the Registrar General of England and Wales show that the death rate per 1,000 in the age period 45-54 was 16.8 in 1880 and in 1910 only 12.7, we must conclude that there has been a decrease of 24 per cent. in the mortality at that age period and that the conditions of life have improved to that extent. But we cannot draw conclusions either one way or the other from similar American figures and for this reason: the character of our population of the earlier period has not remained unchanged. The years which we are considering were years of great change in the race constitution of American states and cities. They were years in which occurred a great influx of newer race stocks, an immigration which is making up a large and ever-increasing part of the population of our registration area. It is indispensable to the argument that the effect of this change in our race stock shall be determined as a part of the phenomenon we are considering. Does it make any difference that we have added to our population millions of Russians and Italians and Poles, whom we did not have at the earlier date? If not, then clearly the increasing mortality means something; it might even indicate physical deterioration after 45 as some writers would have us believe. If it can be shown, however, that these foreign races are contributing to the older ages of our population and that at these ages they have consistently higher mortality rates than our native stock, then the increase in the total mortality indicates nothing as an index of deterioration in the vitality of our native population.

The question resolves itself thus: Are *Americans* today experiencing a shorter expectation of life after 45 than did

Americans of a previous generation? I mean by Americans the native born of native parentage. Statistically, the problem has no meaning or value when stated in terms of the total population. The problem must be analyzed in terms of homogeneous groups of the population and comparisons must be limited within these groups.

For some time I have interested myself in just this phase of the problem. In a recent study of the death rates in the race stocks in New York State, 1910,* I showed how the important races compared with one another in respect to their mortality. Comparisons were made between (1) the native born of native parentage, (2) the native born of foreign or mixed parentage, and (3) the foreign born. Statistics are given in full in that report, but for this occasion, I shall summarize only those results which bear upon the problem of middle and old age mortality. We found consistently that after age 45 the group of native born of native parentage had the lowest mortality. This was true for both sexes. The superiority of the native stock over the foreign born is very marked indeed. The foreign born males had a death rate of 28.0 per thousand in the age period 45-64 as against a rate of 18.8 for the native born of native parentage, which is a difference of about 49 per cent. in favor of the latter group. The foreign born females in the age period 45-64 showed a rate of 23.4 as against a rate of 14.3 for the native born, a difference of nearly 64 per cent. in favor of the native born. The foreign born and the native born of foreign or mixed parentage, were remarkably alike as to the mortality of the males. This was not so for the females, however, the foreign born showing the highest rates.

On further analysis of the foreign born mortality we were able to distinguish the characteristics of the following nationalities: (1) Russians (for the most part Jews, in New York State), (2) Italians, (3) Germans, (4) Irish, (5) Austro-Hungarians, and (6) English, Scotch, and Welsh. Whatever be the foreign stock, virtually the same phenomenon of higher mortality appears in comparison with the native born of native parentage, the differences between the several nationality classes being one of degree only. Even the Russians

* "Factors in American Mortality—A Study of Death Rates in the Race Stocks of New York State, 1910." *American Economic Review*, Vol. VI., No. 3, September, 1916.

(Jews mostly) who are notable for their very low death rates during the early working years of life show consistently higher death rates after age 45 than do the native born of native parentage. When we turn to the Germans and the Irish the differences are remarkable. Thus, the Irish at the period 45-64 showed a rate of 46.3 per 1,000 for men as against 18.8 for the native born of native parentage, and for women, a rate of 40.7 as against 14.3 for the native born women of native parentage. The following table gives the figures for each of the foreign race stocks in comparison with the native born of native parentage for the age periods after 45 and for each of the sexes:

TABLE I.

DEATH RATES PER 1,000 IN PRINCIPAL NATIVITY CLASSES OF NEW YORK STATE POPULATION, 1910, CLASSIFIED BY AGE PERIOD AND BY SEX.

Age Period and Sex.	Native Born of Native Parentage.	Native Born of Foreign or Mixed Parentage.	Foreign Born.	Persons Born in					
				Russia.	Italy.	Germany.	Ireland.	England, Scotland, Wales.	Austria-Hungary.
45-64									
Males . . .	18.8	28.2	28.0	20.1	19.3	27.7	46.3	24.6	21.0
Females . .	14.3	20.0	23.4	16.0	17.9	18.4	40.7	21.0	18.2
65-84									
Males . . .	77.3	89.9	90.4	78.4	64.6	90.4	101.6	86.6	77.5
Females . .	68.2	73.9	87.7	69.8	63.8	83.1	107.4	79.9	63.9

This evidence cannot be discounted when we consider the problem of the increasing mortality after age 45. Its significance is evident when we note the changes that have occurred in the racial composition of the population of New York State during the 10 year period 1900 to 1910. In the former year, 39.2 per cent. of the entire population was native born of native parentage; in the latter year this proportion had fallen to 35.4 per cent. On the other hand, the foreign born white population increased from 26.0 per cent. to 29.9 per cent. The native born of foreign or mixed parentage changed slightly from 33.2 per cent. to 33.0 per cent. The following table shows side by side the proportionate distributions in 1900 and in 1910 of the three main groups of the population in New York State in the several age periods after 45:

TABLE II.

PERCENTAGE OF GENERAL NATIVITY GROUPS IN THE WHITE POPULATION OF NEW YORK STATE AT CERTAIN AGE PERIODS, 1900 AND 1910.

Age Period and Population Group.	1910.	1900.	Difference 1910-1900.
45-54 Years			
Total white population.....	100.0	100.0
Native born, native parentage.....	32.0	39.3	-7.3
Native born, foreign or mixed parentage.....	26.6	18.6	+8.0
Foreign born.....	41.4	42.1	-.7
55-64 Years			
Total white population.....	100.0	100.0
Native born, native parentage.....	39.8	44.4	-4.6
Native born, foreign or mixed parentage.....	18.0	10.3	+7.7
Foreign born.....	42.2	45.3	-3.1
65-74 Years			
Total white population.....	100.0	100.0
Native born, native parentage.....	45.9	49.3	-3.4
Native born, foreign or mixed parentage.....	10.5	5.8	+4.7
Foreign born.....	43.6	44.9	-1.3
75-84 Years			
Total white population.....	100.0	100.0
Native born, native parentage.....	51.2	56.6	-5.4
Native born, foreign or mixed parentage.....	6.3	4.8	+1.5
Foreign born.....	42.4	38.7	+3.7

The above table shows that the main effect of the change in the composition of our population has been to decrease the proportion of the native born of native parentage, that is, the group with the most favorable mortality after age 45. In 1900 this group comprised 39.3 per cent. of the New York State white population aged 45-54, but by 1910 this proportion had dropped to 32.0 per cent. Similarly in the age period 55-64, the proportion of the same group dropped from 44.4 per cent. to 39.8 per cent. The decrease in the proportion of the foreign born is more than balanced by the increase in the native born of foreign or mixed parentage who, as shown in Table I, are much more similar to the foreign born in their mortality characteristics than to the native born of native parentage.

An increase in the proportion of those having higher death rates and a corresponding decrease in the proportion of those having lower death rates must have the effect of increasing the total death rate. From this conclusion there can be no escape. The problem is, indeed, analagous to that of age standardization which is a necessary and accepted procedure in every day vital statistics work. No qualified statistician would com-

pare the crude death rates of two communities without taking into account the character of their age constitution at least. The Census Mortality Reports, for example, specifically give warning of the dangers of not making such corrections. It might very well be that one population had a larger proportion of infants and old people than the other with which it was being compared. I now insist that it is equally fallacious to compare the populations of two periods even for the same state when we know that there has been a change in the race composition and especially when we also know that this change affects the total death rate. In this particular instance, the change in the race composition in New York State has certainly increased the mortality after age 45.

So much for the death rates for all causes combined. The argument runs along very similar lines with reference to the supposed increase in the rates of the more important of the individual causes of death referred to above. The following table shows how much higher the death rates in New York State for two of these causes are for the foreign born than for the native born of the same ages. There are some exceptions, to be sure, but they are not many nor are they very important.

TABLE III.

DEATH RATES PER 100,000 FROM BRIGHT'S DISEASE AND ORGANIC DISEASES OF THE HEART FOR THE PRINCIPAL NATIVITY CLASSES OF NEW YORK STATE POPULATION, 1910.

Cause of Death, Sex and Age Period.	Persons Born in						
	United States.	Russia.	Italy.	Germany.	Ireland.	Austria- Hungary.	England, Scotland, Wales.
Bright's disease							
Males							
45-64.....	267.2	238.6	172.9	332.4	662.5	298.6	288.3
65-84.....	952.2	1322.4	807.9	1306.7	1299.1	1628.9	861.4
Females							
45-64.....	208.6	276.7	211.5	245.2	636.1	241.0	241.9
65-84.....	680.9	1273.6	549.8	1122.3	1388.6	852.6	826.0
Organic diseases of the heart							
Males							
45-64.....	316.3	254.2	250.8	328.9	580.2	244.3	272.1
65-84.....	1693.7	1254.0	1303.1	1905.5	2088.5	1062.3	1903.0
Females							
45-64.....	247.1	239.4	373.6	288.5	656.4	221.3	295.6
65-84.....	1369.3	1485.8	1649.3	1766.5	2312.1	1136.8	1791.4

It is unfortunate that I cannot give you for comparison the figures for the native born of native parentage for these causes. If we had reliable figures for this group the differences shown would stand out in even greater relief. This is clearly indicated in certain data now in our possession which are not yet ready for presentation. The rates for Bright's disease in the age period 45-64 are lowest for males born in the United States except for those born in Russia and in Italy. Males born in Ireland give a rate more than twice that for natives. Among females, ages 45-64, the rate for this disease is without exception lowest for the native born. In the age period 65-84 an occasional exception appears for both males and females; but, taken by and large, Bright's disease is more prevalent at these advanced ages among the foreign born stock than among natives. The figures for organic diseases of the heart, and, as reference to my previous study, "Factors in American Mortality," will show, the figures for other of the degenerative diseases point to a similar conclusion.

The apparent increase in the mortality from these causes in the population since 1900 must, therefore, be considered in the light of the changing character of our race constitution. The facts brought out in the discussion of the general death rates above would seem to have an even greater application in relation to these special causes of death.

I desire finally to consider the degenerative disease problem from another angle. It may throw additional light on the supposed increase in their death rates. The diseases or rather the causes of death are those previously mentioned, but I shall repeat them for the sake of clearness: (1) Cancer, (2) diabetes, (3) cerebral hemorrhage and apoplexy, (4) organic diseases of the heart, (5) diseases of the arteries, (6) cirrhosis of the liver, and (7) Bright's disease. The supposition has been that the true incidence of these diseases has increased because their rates have gone up more or less steadily since 1900. I have shown above that the changing race factor played an important part in this rise, but in addition we must remember that the published rates are more or less subject to the influence of improving technical procedure in statistical offices. This is

not a minor matter. It is especially true of this group of diseases that the methods of classification in the Bureau of the Census and in other registration and compiling offices have been subject to progressive change. This has been the result of decisions of the International Commission and of the ever increasing effort to obtain more specific and complete statements of the primary cause of death. Moreover, many of the diseases under consideration are subject to errors of diagnosis. They often occur together and in combination with other conditions. The routine of stating them on death certificates as causes has not even now become crystallized in the minds of physicians. The last 15 years, moreover, has been a period of increasing interest in these diseases with the result that they are mentioned more often in cases where formerly no reference to them would have been made. All of these factors combined serve to make the group a very unsatisfactory one to discuss on the basis of the bare figures. There is a great deal to explain before comparisons can be made between 1900 and 1914. I propose in the following to take up a number of these diseases and to show how seriously the rates for them have been modified solely as the result of changes in medical and statistical nomenclature and practice.

I. CANCER.

The published rates for cancer have been markedly increased by more definite statements of cause on death certificates. Deaths previously reported as due to "tumor" and assigned to the non-malignant tumor class are now more generally described as cancers of some definite organ. This, moreover, is confirmed by the actual experience of those who have handled large numbers of death certificates and who in their correspondence with physicians have observed how readily a statement of "tumor" can be converted into a statement of cancer as a result of inquiry. We are also charging today many deaths to cancer which, in 1900, on the basis of the descriptions then given by physicians, would have been classified as septicemia, hemorrhage, pulmonary congestion, peritonitis, acute nephritis, and other conditions. This is also true of such titles as "disease" of the brain, "disease" of the

larynx, the mouth, the pharynx, the esophagus, the stomach and various other organs and members of the body usually subject to cancerous growths. Moreover, there is today much more certainty than before in the diagnosis of cancer as the result of the increase in the number of operations and laboratory examinations. The result of these changes in statistical and medical practice has been an increase in the reported death rate from cancer.

II. CEREBRAL HEMORRHAGE AND APOPLEXY.

Much of the apparent increase in cerebral hemorrhage and apoplexy is accounted for by the decrease in reports of "paralysis." In 1900, the rate for the latter disease was 25.9 per 100,000; in 1914 it had fallen to 9.7. Physicians now less frequently report "paralysis" but instead give the cerebral hemorrhage which caused the paralysis.* Furthermore, it is now the practice of vital statistical offices to return certificates where "paralysis" and "hemiplegia" are reported as causes of death and many such cases come back to the registration offices changed to "cerebral hemorrhage." Thus, in the returns of the Statistical Bureau of the Metropolitan Life Insurance Company, 61.1 per cent. of the queries on "paralysis" resulted in changes to "cerebral hemorrhage and apoplexy." These facts together with the known changes in race composition referred to earlier lead us to doubt seriously whether there has been any real increase in the incidence of this disease. All things considered, therefore, I doubt if there is any basis for the conclusion that there has been an actual increase in the mortality from this cause of death.

III. ORGANIC DISEASES OF THE HEART.

The marked changes that have occurred in the statistical treatment of this cause of death are best indicated by a comment appearing in the report of the Bureau of the Census on Mortality Statistics for the year 1910, page 54. In discussing the increase in the published rate from this disease the report says: "A part of this increase, however, was only apparent, being due to the fact that prior to the second revision of the

* In 1900, of the total number of deaths reported from both "paralysis" and cerebral hemorrhage and apoplexy, 27.6 per cent. were ascribed to the former; in 1914 only 11 per cent. were so returned.

International List, all deaths reported as due to 'endocarditis' (unqualified) and 'myocarditis' (unqualified) were compiled under 'acute endocarditis' (International Title No. 78), whereas in the compilation of 1910 the classification of the second revision has been used and such deaths of persons 60 years of age or over have been classified under 'organic diseases of the heart.' " This change in the classification of endocarditis and myocarditis has been in force since 1910.* Change in accepted procedure in editing jointly returned causes of death has also played a part in this seeming increase in the mortality from organic heart diseases. The Index of Joint Causes of Death published by the Bureau of the Census in 1913 shows that specifically reported causes like "mitral insufficiency," "valvular disease of the heart," etc., are now made preferred causes over certain diseases such as intestinal obstruction, paralysis agitans, tubo-ovarian abscess, Ludwig's angina, renal calculus, elephantiasis, and others. These, on the other hand, when reported in combination with less definite terms like "heart disease" are made preferred causes over the latter. Each year fewer physicians are returning "heart disease" and more of them are returning such definite reports as "mitral insufficiency." Finally, many deaths which formerly were returned as due to "dropsy" and to other conditions which were classified under the general heading "ill-defined organic disease," have lately been definitely ascribed to organic diseases of the heart. "Ill-defined organic diseases" have dropped from 7.2 per 100,000 in 1900 to 0.8 in 1914. These causes are especially prominent in the older ages. The consequence is that, more and more, deaths are being charged to organic heart diseases which formerly would have been tabulated elsewhere.

IV. DISEASES OF THE ARTERIES.

The immense increase in the published rate for diseases of the arteries is obviously not in accord with the facts. We are concerned simply with artifact—a change in the practice of physicians in reporting the causes of death in old age. It is

* In fact, in each report on mortality since and including that for 1910 the Bureau of the Census has placed on title No. 79 (Organic diseases of the heart) in its table giving rates for diseases for several years an asterisk to indicate that there have been changes "markedly affecting the comparability of the figures."

the experience of persons who have been engaged for years in handling death certificates that deaths which are now charged to arteriosclerosis would often have been reported in former years as due to "old age." In 1900, the death rate for "old age" was 50.4 per 100,000 and in 1914 it was only 19.8, that is, less than two fifths of the earlier rate. The interest of the medical profession has in recent years been directed toward arteriosclerosis and to allied diseases with the result that these diseases are more often reported where previously little attention would have been given to them. Hardened arteries may be assumed to be a normal condition in old age rather than a morbid one and it is partly because of the newer interest in the etiology of the condition that more deaths are being reported as due to them.

The progress that has been made in defining statements of cause of death is shown to some extent by the marked reduction in the death rates of all causes which are vague and indefinite in their nature. We have already referred to the decline in the rate for the ill-defined diseases. Deaths which were previously referred to this unsatisfactory group of causes are now very commonly classified at the older ages under more specific and definite titles, especially under one or another of the so-called "degenerative diseases."

SUMMARY AND CONCLUSION.

On the main subject at issue I am constrained to conclude that there is no evidence to support the contention that the true mortality rate of the country has increased after age 45. The problem will be decided definitely only when a new set of life tables, similar to those issued by the Census Bureau for the year 1910, appear at later decennial periods. No such data are now at hand. Enough facts are in evidence, however, to warrant the conclusion that the changing constitution of our race stock is responsible for the slight increase in mortality that has occurred. It is perfectly true that the marked decreases in mortality which are characteristic of the earlier ages of life do not continue after age 45. Nor could they be expected to under any circumstances. Immortality is not one of our characteristics. Persons who do not die from the in-

fections and accidents at the earlier ages will necessarily come to death at the more advanced ages. This is no cause for apprehension from the health or any other community standpoint. We are not concerned with a social misfortune when the mortality after age 75 increases and apparently the figures indicate that for the present at least no increases have occurred up to that advanced age.

As to the alleged increase in the death rate from the so-called degenerative diseases, the causes of death most prominent in middle and old age, these are due to two factors; first, to the changes in our race composition, and second, and perhaps equally important, to the changes in International and local statistical practice with reference to their assignment on death certificates. Together, these facts throw grave doubt on the assumption that any of these diseases has increased at the ages in which we are economically and socially interested. It is high time, therefore, that the ghost of these degenerative diseases was laid and the program for life conservation at middle life and at the older ages was established upon sound scientific premises. It is not necessary to urge a worthy cause on false assumptions. It is very desirable to call attention to bad habits of life, to overeating and drinking, to lack of exercise, all of which result in degenerative processes; and it is certainly to be desired that persons shall have themselves physically examined each year in order to discover impairments and defects when they are only slightly developed rather than to allow them to proceed until a breakdown occurs. This movement deserves the support of all and indeed has given good evidence of excellent returns for the future. In this paper, however, I must insist that the program of life conservation shall not continue to be tied up to or made dependent upon misleading statistics. There is no evidence at hand at the present time to justify the statement that conditions of life in America are increasing the mortality rates at the productive ages.

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